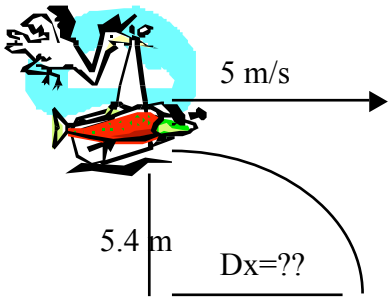
NAME_____
ANSWERS BOOK WORK CHAPTER 3 Projectiles

Pg. 102

1) A pelican flying along a horizontal path drops a fish from a height of 5.4 m while traveling 5 m/s. How far does the fish travel horizontally before it hits the water below?

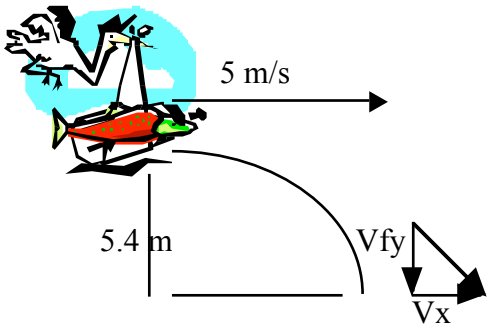


X
Vx = 5 m/s
Dx =??
T=??
Dx=Vx T

Y
Viy = 0 m/s
Ay = -9.8 m/s^2
Dy= -5.4 m

Dy = Viy T + ½ Ay T^2
-5.4 = 0 (T) + ½ (-9.8) T^2
-5.4 = -4.9 T^2
T= 1.05 sec
Back to X
Dx=5(1.05)=5.25 m

2) Give both the horizontal and vertical components of the velocity of the fish from item 1 before the fish enters the water. (Find Vfx and Vfy if Dy= -5.4m, Vix= 5 m/s , Viy=0)



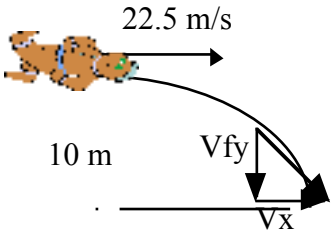
X
Vfx=Vx= 5 m/s
Y
Dy = -5.4 m
Ay = -9.8 m/s^2
Viy = 0 m/s
Vfy = ????

Vfy^2=Viy^2 + 2 Ay Dy
Vfy^2=(0) + 2 (-9.8) (-5.4)
Vfy^2=105.84
Vfy = - 10.29 m/s (downward)

For the final velocity
V^2 = Vx^2+ Vy^2
V^2 = 5^2 + (10.29)^2
V= 11.44 m/s θ = tan $^{-1}$ (Vy/Vx) = tan $^{-1}$ (10.29/5) = 64 degrees to the water

Final Velocity is 11.44 m/s at 64 degrees to the water

3) Find the instantaneous velocity of the stunt dummy in Sample Problem 3D as it hits the water. (Find Vfx and Vfy if Dy= - 10 m, Vix= 22.5 m/s , Viy=0)

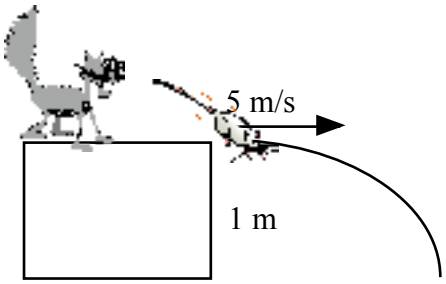


X
Vfx=Vx= 22.5 m/s
Y
Dy = -10 m
Ay = -9.8 m/s^2
Viy = 0 m/s
Vfy = ????

$Vfy^2=Viy^2 + 2\ Ay\ Dy$
$Vfy^2=(0) + 2\ (-9.8)\ (-10)$
$Vfy^2=196$
Vfy = - 14 m/s (downward)

For the final velocity
$\mathbf{V}^2 = Vx^2+ Vy^2$
$\mathbf{V}^2 = 22.5^2 + (14)^2$
V= 26.5m/s
$\theta = \tan^{-1} (Vy/Vx) = \tan^{-1} (14/22.55) =$ 31.9 degrees to the ground
Final Velocity is 25.5 m/s at 31.9 degrees to the ground

4) A cat chases a mouse across a 1.0 m high table. The mouse steps out of the way and the cat slides off the table at a speed of 5 m/s. Where does the cat strike the floor?



X
Vx = 5 m/s
Dx =??
T=??
Dx=Vx T

Y
Viy = 0 m/s
Ay = -9.8 m/s^2
Dy= -1 m

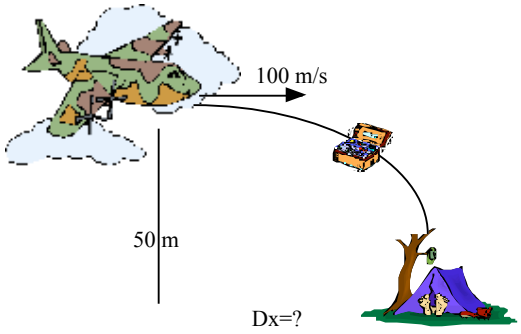
$Dy = Viy\ T + ½\ Ay\ T^2$
$-1 = 0\ (T) + ½\ (-9.8)\ T^2$
$-1 = -4.9\ T^2$
T= .45 sec
Back to X
Dx=5(.45)=2.26 m

ANSWERS Bookwork Chapter 3 pg. 105 Section Review (do on fresh paper so you have room!)

1) Which of the following are examples of projectile motion?
a) airplane taking off, ***b) tennis ball lobbed over a net.*** c) plastic disk sailing over the lawn d) a hawk diving to catch a mouse e) a parachutist drifting to Earth ***f) a frog jumping from the land into the water.***

2) Which of the following exhibit parabolic motion?
a) a flat rock skipping over the surface of the lake b) a three point shot in basketball c) the space shuttle while orbiting the Earth ***d) a ball bouncing across the room e) a cliff diver*** f) a life preserver dropped from a stationary helicopter ***g) a person skipping***

3) An Alaskan rescue plane drops a package of emergency rations to s stranded party of explorers. The plane is traveling horizontally at 100 m/s at a height of 50 m above the ground. What horizontal distance does the package travel before striking the ground?

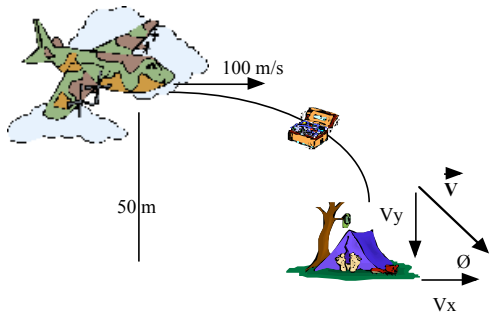


X
Vx = 100 m/s
Dx =??
T=??
Dx=Vx T

Y
Viy = 0 m/s
Ay = -9.8 m/s^2
Dy= -50 m

Dy = Viy T + ½ Ay T^2
-50 = 0 (T) + ½ (-9.8) T^2
-50 = -4.9 T^2
T= 3.19 sec
Back to X
Dx=100 (3.19)=319 m

4) Find the velocity (vector magnitude and direction) of the package in item 3 just before it hits the ground.

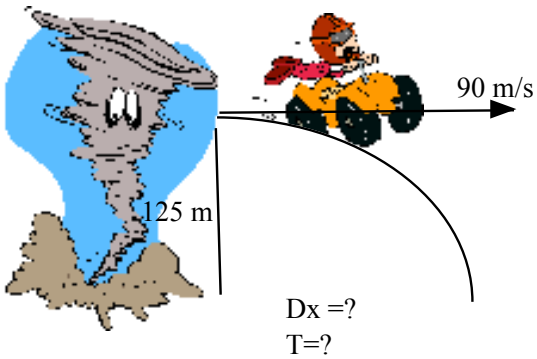


X
Vfx=Vx= 100 m/s
Y
Dy = -50 m
Ay = -9.8 m/s^2
Viy = 0 m/s
Vfy = ????

Vfy^2=Viy^2 + 2 Ay Dy
Vfy^2=(0) + 2 (-9.8) (-50)
Vfy^2= 980
Vfy = - 31.3 m/s (downward)

For the final velocity
V^2 = Vx^2+ Vy^2
V^2 = 100^2 + (31.3)^2
V= 104.7 m/s
θ = tan $^{-1}$ (Vy/Vx) = tan $^{-1}$ (31.3/100) = 31.9 degrees to the ground
Final Velocity is 104.7 m/s at 17.38 degrees to the ground

5) During a thunderstorm, a tornado lifts a car to a height of 125 m above the ground. Increasing in strength, the tornado flings the car horizontally with an initial speed of 90 m/s. How long does the car take to reach the ground? How far horizontally does the car travel before hitting the ground?

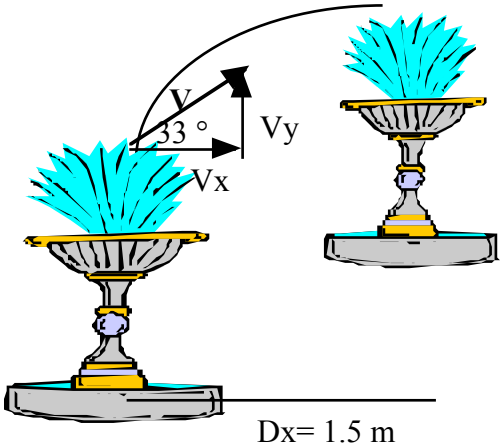


X
Vx = 90 m/s
Dx =??
T=??
Dx=Vx T

Y
Viy = 0 m/s
Ay = -9.8 m/s^2
Dy= -125 m

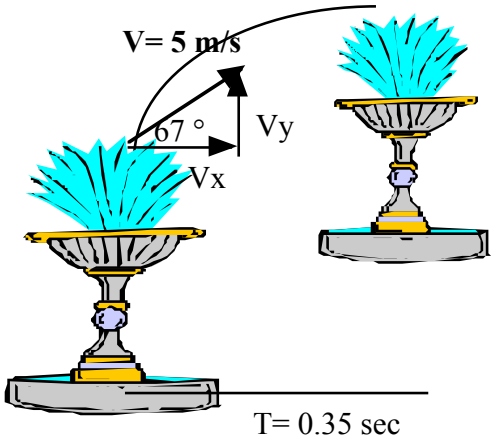
Dy = Viy T + ½ Ay T^2
-125 = 0 (T) + ½ (-9.8) T^2
-125 = -4.9 T^2
T= 5.05 sec
Back to X
Dx=90 (5.05)=454.57 m

*** 6) Streams of water in a fountain shoot from one level to the next. A particle of water in a stream takes 0.5 seconds to travel between the first and the second level. The receptacle on the second level is a horizontal distance of 1.5 m away from the spout on the first level. If the water is projected at a 33 ° angle, what is the initial speed of the particle?



X
Dx = 1.5 m
T = 0.5 sec
Dx = Vx T
1.5 = Vx (.5)
Vx = 3 m/s
Vx = V cos (θ)
3 = **V** cos (33)
3 = **V** (.83867)
V = 3.577 m/s

*** 7) If a water particle in a stream of water in a fountain takes 0.35 seconds to travel from spout to receptacle when shot at an angle of 67° and an initial speed of 5 m/s, what is the vertical distance between the levels of the fountain?



Y

Vy = **V** sin (θ)
Vy = 5 sin (67)
Viy = 4.6 m/s
Ay = - 9.8 m/s^2
T = 0.35 sec
Dy = ????
Dy = Viy T + ½ Ay T^2
Dy = 4.6 (.35) + ½ (-9.8) (.35)^2
Dy = 1.61 + -4.9 *.1225
Dy = 1.00975 m